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# *Indian Standard*

# GLOSSARY OF TERMS RELATING TO IRON AND STEEL

## PART VII WROUGHT IRON

## *(First Revision)*

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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*November* 1976

# *Indian Standard*

# GLOSSARY OF TERMS RELATING TO IRON AND STEEL

## PART VII WROUGHT IRON

## *( First Revision )*

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# *Indian Standard*

# GLOSSARY OF TERMS RELATING TO IRON AND STEEL

## PART VII WROUGHT IRON

## *( First Revision )*

## 0. FOREWORD

**0.1** This Indian Standard ( Part VII ) ( First Revision ) was adopted by the Indian Standards Institution on 21 May 1976, after the draft finalized by the Metal Standards Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** This standard was first published in 1962. As a result of experience gained during these years, certain modifications have been made in some of the meanings of various terms. The Sectional Committee while issuing this revision felt it desirable to issue the standard in separate parts. Other parts of the standard are as follows:

| | |
|---|---|
| Part I | General metallurgy, heat treatment and testing |
| Part II | Steel making |
| Part III | Hot-rolled steel products ( excluding sheet and strip ) |
| Part IV | Steel sheet and strip |
| Part V | Bright steel bar and steel wire |
| Part VI | Forging ( including drop forging ) |
| Part VIII | Steel tubes and pipes |

**0.3** This standard has been prepared to assist the manufacturers and the users in uniform interpretation of the common terms used in the iron and steel industry.

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## 1. SCOPE

**1.1** This standard ( Part VII ) is intended to convey the meanings of the terms relating to wrought iron.

## 2. TERMINOLOGY

**2.1 Ball Furnace** — A furnace for heating piles of iron to a welding temperature for subsequent forging into a bloom or slab.

**2.2 Ball Furnace Pile** — *See* **2.81.2.**

**2.3 Balling** — Gathering the pasty iron, produced by puddling, into a ball.

**2.4 Ball Puddled Iron** — The spongy mass, weighing about 60 kg, produced by aggregating iron particles in the puddling furnace.

**2.5 Bar** — Finished product of solid section which may be rectangular, square, round, half-round or polygonal. The dimensions generally conform to the following ( *see also* **2.5.1** );

*Rounds and Half-Rounds* — Minimum diameter 5 mm.

*Squares and Polygonals* — Minimum side 6 mm.

**2.5.1** *Flat Bar* (*Flat*) — A finished product, generally of rectangular cross section, with edges of controlled contour and of thickness 3 mm and over and width 400 mm and below, supplied in straight lengths. The product shall have rolled edges only ( square or slightly rounded ). This group also includes flat bars with bulb that has swelling on one or two faces of the same edge and a width of less than 400 mm.

**2.6 Billet** — A semi-finished product obtained by forging, rolling or continuous casting, usually square and not exceeding 125 × 125 mm in cross section with rounded corners and intended for further processing into suitable finished products by forging or re-rolling.

**2.7 Blister** — Local separation of a layer of steel due to accumulated gas, causing a protuberance on the surface, underneath which is a cavity.

**2.8 Bloom** — A semi-finished forged, rolled or continuously cast product intended for re-rolling or forging. The cross section is square or rectangular ( excluding slab ) and is generally more than 125 × 125 mm ( or equivalent cross-sectional area ).

**2.9 Blue Billy ( Purple Ore )** — The iron oxide residue from the manufacture of sulphuric acid from iron pyrites containing approximately 50 percent iron. It is used for fettling the puddling furnace.

**2.10 Boil** — A particular stage of open-hearth steelmaking or puddling wrought iron corresponding to the evolution of carbon monoxide gas, as a result of which the molten steel bath appears like a boiling liquid.

**2.11 Boilings** — The cinder which overflows from the puddling furnace during the boil.

**2.12 Broken Corners** — *See* **2.25**.

**2.13 Bull Dog** — Roasted tap cinder, consisting of ferric oxide and silica, derived from the puddling furnace. It is used for fettling.

**2.14 Burnt Edges** — Broken edges occurring during hot rolling and caused by overheating or burning ( *see also* **2.25** ).

**2.15 Burr** — The sharp fringe of metal left on a sheared or saw cut bottom edge ( *see also* **2.37**).

**2.16 Bushelling** — Compacting wrought iron turnings, borings and scrap into a bloom or slab by heating to a welding temperature and forging.

**2.17 Cable Iron** — Wrought iron in various qualities for the manufacture of cables ( *see also* **2.90** ).

**2.18 Charcoal Grade Iron** — Iron, usually of high quality, produced by using charcoal as the fuel.

**2.19 Checked Edges** — Cracked edges in sheet bars and strips occurring during hot rolling.

**2.20 Chill Cracks (Fire Cracks )** — Marks on a rolled surface resulting from cracks in the surface of a roll used for hot rolling. A particular form of roll mark. Surface cracks found on rolls are usually caused by alternate heating and cooling or by overheating of the rolls in service, in which case they are called fire cracks.

**2.21 Chipping** — Removing surface defects by manual or pneumatic chisel.

**2.22 Cinder** — The molten by-products produced in furnace used for puddling, bushelling or reheating. The chemical composition varies, but is essentially silicate of iron.

**2.23 Cogging ( Roughing )** — The action of reducing, by hot working, an ingot into a bloom or slab for subsequent rolling or forging.

**2.24 Coming to Nature** — The stage of the puddling process when particles of solid iron clearly form in the molten bath, which can then be worked into balls by the puddler.

**2.25 Cracked Edges ( Broken Corners )** — Cracks across the edges ( that is, at right angles to the direction of rolling ) of a rolled product. The term 'broken corners' is used in connection with large sections, for example, blooms, billets and slabs. ( *See also* **2.14** ).

**2.26 Cropping** — Shearing off discard from the ends of an ingot, a bloom or a forged product prior to further working. End discard shearing of semi-finished or finished products is also called cropping ( *see also* **2.32** ).

**2.27 Cross Piling** — Arranging material in such a way that the consecutive layers are at right angles to each other.

**2.28 Cross Rolling** — Rolling in the direction transverse to the longitudinal axis of the ingot or slab, as in the production of plate or sheet.

**2.29 Crown Quality; Crown Best Quality; Crown Best Best Quality; Crown Best Best Best Quality** — Commercial descriptions of different grades of wrought iron ( *see also* **2.90** ).

**2.30 Descaling** — Removal of surface scale from a hot worked or heat treated product by pickling, shot-blasting, etc. Also removal of scale during hot working by the application of water, coal dust, brushwood, oil, etc.

**2.31 Direct Process** — Production of wrought iron from ore in one operation.

**2.32 Discard** — Those portions corresponding to the top and bottom of the ingot which are removed to ensure that the remainder of the material is of satisfactory quality. Also defective material produced in rolling or forging, to be cut from one or both ends of the semi-finished or finished product ( *see also* **2.26** ).

**2.33 Double Faggoted Refined Iron** — Wrought iron which has been twice worked through the reheating furnace and rolls.

**2.34 Dry Puddling** — Puddling on a sand bottom with a high grade low silicon pig iron, when the metal does not become molten, but only pasty, and the decarburization is done by air.

**2.35 Edging** — The application of rolls to the edges of a rectangular section, for example, slab, plate, strip and flat, with the object of controlling width and giving a smooth edge during the rolling process.

**2.36 Faggoted Iron** — Bars or sections rolled or forged from a mill pile built up from bar ends.

**2.37 Fash ( Burr; Flash )** — Sharp and jagged edges left after shearing or sawing ( *see also* **2.15** *and* **2.43** ).

**2.38 Fettling**

a) Making up the lining of the puddling furnace.
b) The material used for removing impurities in the puddling process.

**2.39 Fibrous Fracture** — A fracture characteristic of wrought iron. A dull grey fracture in which considerable distortion has occurred, indicative of toughness.

2.40 **Finery** — A hearth which may be used for purifying pig iron in the manufacture of charcoal grade wrought iron.

2.41 **Finishing** — The later stages of a rolling process wherein the material is brought to the desired shape and dimensions. It also refers to the processes of cutting to length, drilling, machining, straightening, dressing, oiling, etc, of the finished products.

2.42 **Finishing Temperature** — The temperature at which hot working is completed.

2.43 **Fin ( Overfill; Flash )** — A protruding rib of metal running longitudinally along a rolled product, such as results from overfilling a pass ( *see also* 2.37 ).

2.44 **Fire Cracks** — *See* 2.20.

2.45 **Fire Waste** — *See* 2.63.

2.46 **Fish Tail** — The V-shaped cavity which may develop at the end of the piece during hot rolling.

2.47 **Flash** — *See* 2.37 and 2.43.

2.48 **Flat** — *See* 2.5.1.

2.49 **Flat Bar** — *See* 2.5.1.

2.50 **Flue Cinder ( Mill Furnace Cinder )** — Cinder tapped from the flue of a reheating furnace.

2.51 **Forge** — The section of the works used to produce wrought iron blooms, slabs or bars for subsequent reheating and re-rolling.

2.52 **Forge Pigs** — Pig iron suitable for conversion to wrought iron in the puddling furnace.

2.53 **Forge Scale** — Scale produced on the surface of the product during forging.

2.54 **Forging** — An article produced by hot working the metal under a hammer or press. It may also refer to the process followed in producing the article.

2.55 **Goethic Section** — A rolled or forged product having approximately square section. The dimensions are specific with specified radius or chamfer at corners without any concavity on the sides.

2.56 **Guide Mark ( Guide Scratch; Guide Score; Guide Shearing )** — A surface defect resulting from abrasion between the steel/iron and a guide used for ensuring location in rolling.

**2.57 Guide Score** — *See* **2.56.**

**2.58 Guide Scratch** — *See* **2.56.**

**2.59 Guide Shearing** — *See* **2.56.**

**2.60 Hammering** — Compacting a spongy puddled ball to a solid bloom by forging under a hammer (*see also* **2.109**).

**2.61 Hammer Scale** — Scale falling off during hammering or squeezing.

**2.62 Hammer Slag** — Slag expelled from the puddled ball by hammering or squeezing.

**2.63 Heat Waste (Fire Waste)** — The loss of material by scaling in a reheating or hot working process.

**2.64 Horse Shoe Quality** — A quality of wrought iron specially manufactured for horse shoes ( *see also* **2.90** ).

**2.65 Hot Sawing** — Cutting hot iron to length during or immediately following hot rolling, by a circular saw.

**2.66 Inclusions ( Non-metallic Inclusions )** — Particles of oxides, silicates, sulphides, refractories, etc, embedded in the metal. These are products of deoxidation.

**2.67 Lamination** — A defect in rolled materials, characterized by a tendency to split into layers along the direction of rolling usually due to the presence of non-metallic inclusions or other discontinuity in the steel.

**2.68 Lap ( Overlap; Shut )** — A surface defect caused by the folding of a mental surface against itself.

**2.69 Malleable Iron** — The term usually means malleable cast iron but it is sometimes applied to wrought iron also.

**2.70 Merchant Bar** — A trade term for black bar.

**2.71 Mill Furnace Cinder** — *See* **2.50.**

**2.72 Mill Pile** — *See* **2.81.1.**

**2.73 Mill Scale** — Oxide layer ( scale ) formed during heating of the bar, which is dislodged at the mill and collected.

**2.74 Muck Bar** — Semi-finished bar produced in the forge.

**2.75 Non-metallic Inclusions** — *See* **2.66.**

**2.76 Overfill** — *See* **2.43.**

**2.77 Overlap** — *See* 2.68.

**2.78 Pass** — *See* 2.100.

**2.79 Pickling** — The removal of scale by chemical or electrochemical treatment with dilute acids or other chemicals, followed by washing.

**2.80 Pig Boiling** — The process now known as puddling.

**2.81 Piling**

2.81.1 *Mill Pile* — A number of forge bars placed one on top of the other, ready for heating to a welding temperature and rolling into bars and sections.

2.81.2 *Ball Furnace Pile* — A suitably arranged pile of scrap which, after heating to welding temperature, is hammered into a solid bloom for rolling into semi-finished forge bars.

**2.82 Pitted Surface** — A surface containing small cavities resulting from unsatisfactory processing.

**2.83 Planishing** — Improving the\surface by the action of chill cast or hardened steel rolls or by hammering with smooth faced hammer.

**2.84 Plate** — A hot or cold rolled flat product, rolled from an ingot or slab, in rectangular cross section of thickness 5 mm and above and width 600 mm and above, and supplied in straight lengths.

**2.85 Puddled Bar** — Flat bar produced from puddled iron by hammering or squeezing and then rolling.

**2.86 Puddled Bloom or Billet** — Semi-finished iron of approximately square section produced from puddled material.

**2.87 Puddler's Candles** — The jets of flame produced when carbon monoxide is released from the molten bath in the puddling furnace at the boiling stage.

**2.88 Puddling** — The process used for the production of wrought iron pig iron and cast iron by means of chemical action. This process was invented in 1780. The older process, dry puddling, is known as "Cort's process" and the newer, wet puddling or pig boiling, is known as "Hall's process".

**2.89 Purple Ore** — *See* 2.9.

**2.90 Qualities** — Distinctive grades and types of wrought iron, for example, 'Crown', 'Cable', 'Best', 'Marked Bars' and 'Yorkshire Iron'.

**2.91 Rabbling** — Working with a rabble, that is, the tool provided for stirring the molten metal in a puddling furnace with cinder to assist purification.

**2.92 Ragging** — Depressions sometimes cut in the face of a cogging or roughing roll with the object of preventing skidding between the roll and the iron.

**2.93 Reeling** — Straightening ( and planishing ) a round bar by feeding it between contoured steel rolls in a direction approximately parallel to the principal axes of the rolls.

**2.94 Refined Grade** — High quality material containing the minimum of impurities.

**2.95 Refinery** — A hearth in which pig iron is partly decarburized with the addition of suitable ingredients to prepare it for dry puddling.

**2.96 Reheating** — Heating steel to a uniform temperature in readiness for hot working.

**2.97 Rolled-in Scale** — Local areas of scale pressed into the surface of the stock during rolling.

**2.98 Rolling** — The shaping of the metal by passing it between two rotating rolls.

**2.91 Roll Marks** — Periodic surface defects due to some imperfection on the surface of a roll.

**2.100 Roll Pass ( Pass )** — Opening of a definite shape formed between a set of rolls through which hot steel passes for taking up the given shape or undergoing a desired amount of reduction in cross-sectional area. This term also applies to a single passage through a pair of rolls for the purpose of altering the shape and/or reducing the cross-sectional area.

**2.101 Roughing** — *See* 2.23.

**2.102 Scab** — Irregular shaped patches of metal on ingot surface arising from cavities in mould walls or caused by loosely adhering layers of metal ( *see also* **2.108** ).

**2.103 Scarfing** — Making a chamfered end for hammer welding two bars together.

**2.104 Seams** — Long shallow grooves or striations formed during working by the elongation of oxidized surface or subsurface blowholes. Seams may also be caused by rippled surfaces or by recurrent teeming laps.

**2.105 Section** — A hot rolled product widely used for structural purposes, with a cross section of special contour. The common types are as shown in Fig. 1.

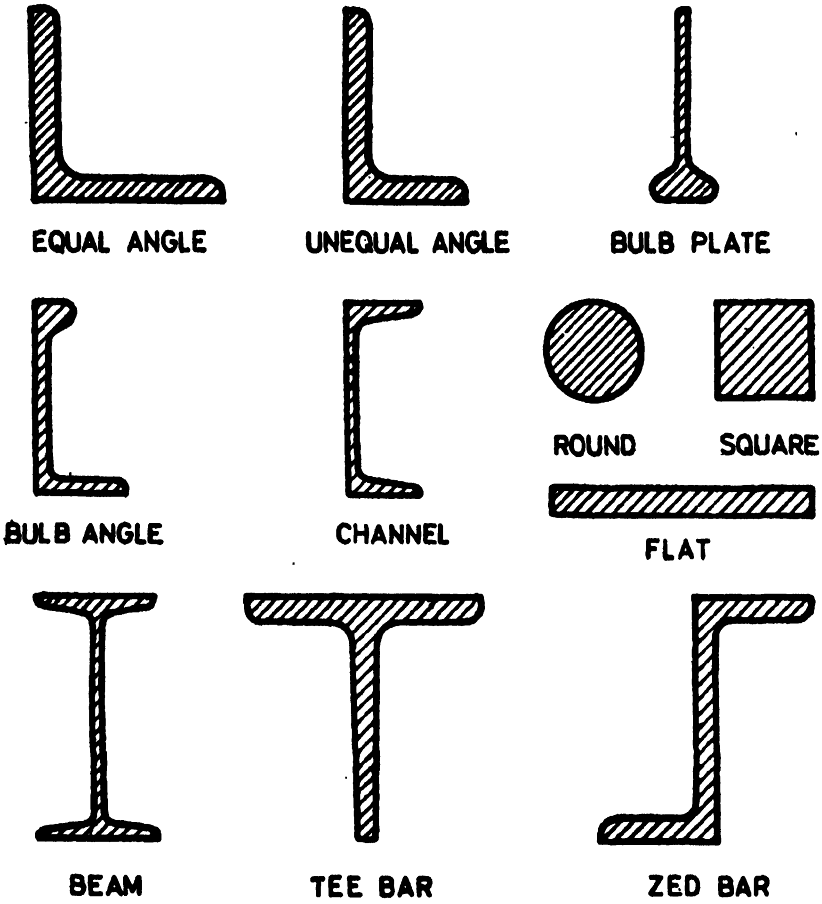

Fig. 1 Common Sections for Structural Purposes

**2.106 Sheet Bar (Slab Bar)** — Semi-finished product of rectangular section, of thickness not less than 6 mm and width not less than 150 mm, and of such dimensions that the thickness does not exceed one-fourth of the width. This term also includes tin plate bars.

**2.107 Sheet Slab** — A slab of suitable size for rolling into sheet.

**2.108 Shell ( Scab; Sliver; Spill )** — A relatively thin film or tongue of metal imperfectly attached to the surface of steel. The defect on the sides of the ingot caused by metal splashes during teeming, the splashes having solidified and struck to the mould wall, is also called shell.

**2.109 Shingling** — Hammering or squeezing a ball of iron to form a puddled bloom or billet with the object of solidifying the metal and expelling as far as possible the inter-mixed liquid slag.

**2.110 Shut** — *See* 2.68.

**2.111 Slab** — A semi-finished rolled, forged or continuously cast product intended for re-rolling or forging. The cross section is rectangular. The thickness does not exceed one-third of the width.

**2.112 Slab Bar** — *See* 2.106.

**2.113 Sliver** — *See* 2.108.

**2.114 Spill** — *See* 2.108.

**2.115 Squeezing** — Forming a bloom or billet by pressure instead of by hammer blows.

**2.116 Staffordshire Iron** — High grade wrought iron originally made in Staffordshire from local iron ore. Now a trade term for wrought iron, it is of no special significance without further qualification.

**2.117 Staffordshire Marked Bars** — Well known qualities made to the maker's guarantee ( *see also* 2.90 ).

**2.118 Tap Cinder ( Tappings )** — Cinder, generally approximately 50 percent iron, tapped from a puddling furnace at the end of the wrought iron making process.

**2.119 Tappings** — *See* 2.118.

**2.120 Underfill** — A cross section which has not filled up the roll pass, so that it is inaccurate in both shape and dimensions.

**2.121 Wash Heating ( Swealing )** — The soaking of an ingot or partly cogged ingot ( after limited rolling ) at high temperature under oxidizing conditions so that surface melts and runs off as fluid slag. Surface defects of an ingot or partly cogged ingot may be removed in this way.

**2.122 Wet Puddling** — Puddling which is done on a bottom, rich in iron oxides and in which the metal is brought to the molten state in order to assist the removal of impurities by intimate reaction with the molten fettling.

**2.123 Wrought Iron** — A very low carbon iron containing varying amounts of mechanically included slag. The chief characteristic of wrought iron is that the temperatures employed in its production are so low that it never gets liquified beyond pasty or semi-fused state.

**2.124 Yorkshire Iron** — Wrorght iron originally made in Yorkshire which had a high reputation for quality, but now used as an indication of high quality ( *see also* 2.90 ).

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## PART 7 WROUGHT IRON

## (First Revision)

(*Page* 4, *clause* 2.5, *first sentence*) - Substitute the following for the existing first sentence:

'2.5 *Bar* - Finished product of solid section generally supplied in straight length, which may be rectangular, square, round or half round or polygonal.'

(SMDC 1)

Reprography Unit, BIS, New Delhi, India

# AMENDMENT NO. 2 MARCH 1989
# TO
# IS : 1956 ( Part 7 ) - 1976 GLOSSARY OF TERMS RELATING TO IRON AND STEEL

## PART 7 WROUGHT IRON

## ( *First Revision* )

[ *Page* 4, *clause* 2.5 (*see also Amendment No.* 1 ) ] — Substitute the following for the existing clause:

'**2.5 Bar and Rod** — Finished product of solid section generally supplied in straight length, which may be rectangular, square, round or half round, or polygonal. The bars may be supplied in coil form also. The dimensions generally conform to the following ( *see also* **2.5.1** ):

a) *Rounds and Half-Rounds* — Minimum diameter 5 mm.

b) *Squares and Polygonals* — Minimum side 6 mm.'

( SMDC 1 )

Reprography Unit, BIS, New Delhi, India